STATE OF ILLINOIS
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AN EVALUATION OF THE RED FOX

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Biological Notes No. 35
Printed by Authority of the State of Illinois

NATURAL HISTORY
SURVEY DIVISION
Harlow B. Mills, Chief

Urbana, Illinois
July, 1955

The red fox is at its majestic best in a winter habitat. Photo from Adolph Murie.

The red fox occasionally maintains a trail for convenience of movement.

The red fox spends most of its life above ground. Shown above is a bedding site.

AN EVALUATION OF THE RED FOX

Thomas G. Scott

Human interest in the red fox tends to take form in several points of view. The sportsman who loves the chase sees this fox as a magnificent quarry for the hounds; the small game hunter responds with concern that the fox is making inroads on his game bag; and the poultry raiser fears the fox as an enemy of his flock. And so it goes; each of the several roles which this fox plays attracts its own particular brand of attention.

There is a need for bringing the various interests together for evaluation as a whole. Such an approach may lead to an understanding of the red fox as a complete animal, and not, in a sense, as a dismembered creature.

Economists tell us that the worth of an item depends upon supply and demand. Perhaps we can best begin our evaluation of the red fox with an appraisal of supply and demand. Supply, in this instance, concerns the population levels of the red fox; demand represents the degree of desire or lack of it for this animal on the part of the public.

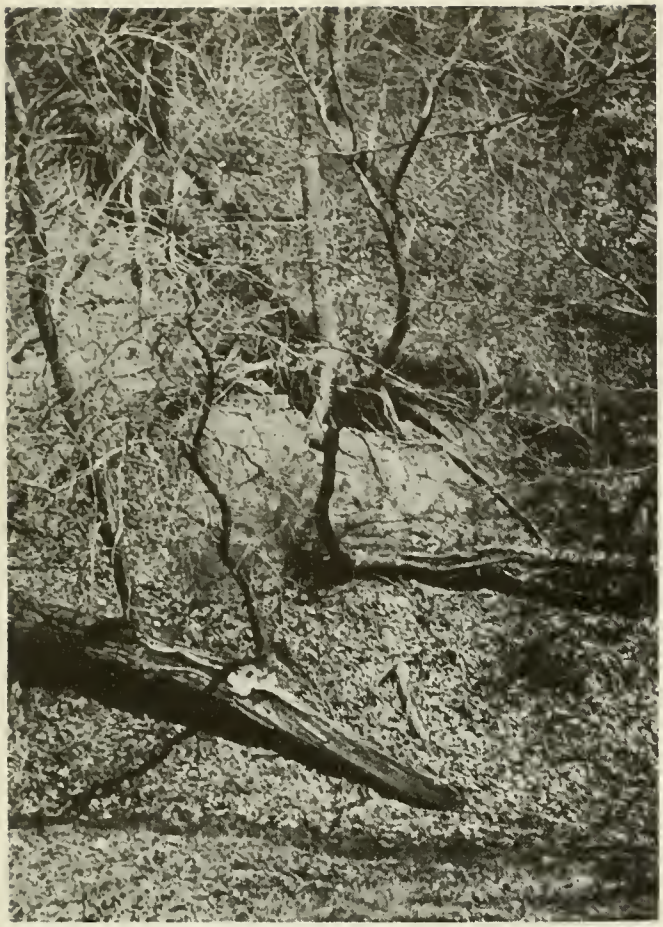
Red fox populations have held up remarkably well in recent times. As a matter of fact, red foxes have shown unusual capabilities in the severe competition for survival in our civilization. Recent numbers of red foxes and the numbers present before the arrival of white settlers cannot be compared as a means of emphasizing this point, because detailed information on the fox populations of early times is not available. Our understanding of favorable environment for red foxes, however, indicates that the opening up of forest lands and the reduction or elimination of wolves and coyotes favored these foxes.

Some conception of the possible levels of supply of red foxes in recent times may be obtained from published records. On 576 square miles of average range (Boone County, Iowa), a population of one red fox to 1.6 square miles was estimated for late spring in 1938 (Scott & Selko 1939: 95). In 1951, in a New York locality of high populations that included both red foxes and gray foxes, 46.2 foxes per trapper-month were taken for 7.5 trapper-months on 176 square miles (Colson & McKeon 1952:3). The possibility that some of these foxes had moved into this area during the time it was being trapped should not be overlooked. McKeon (letter of July 30, 1953) reported that more than 95 per cent of the foxes taken during this New York operation were red foxes. Higher densities have been witnessed in more limited areas, especially in late spring and summer before the young of the year have dispersed from the rearing areas. In Boone County, Iowa, two fox families containing 4 adults and 11 cubs are known to have lived within a home range of approximately 3 square miles (Scott 1943:444-5). Sheldon (1950:41) reported an extreme case in which five litters of red fox cubs were found within 200 acres; 25 foxes were caught in traps within 100 acres in this vicinity in June before the cubs had dispersed (Sheldon 1950:36).

Such evidence of reproductive success shows that the red fox is adapted to existence in our modern world. As a matter of fact, it seems evident from some reports on rabies outbreaks in the eastern United States that it is fully capable of reaching population levels which are too high to serve its own best interest. Whether viewed with favor or otherwise, this ability to survive with such eminent success in a hostile environment constitutes a factor of considerable economic significance.

The demand for red foxes depends in part upon the degree of human understanding and tolerance. Many people who live in areas regularly occupied by red foxes tend to accept them as an interesting part of the environment. The number of sportsmen who enjoy running foxes with hounds is usually highest among these people. When foxes become overabundant, there seems to be a tendency for more of them to appear outside of the habitat to which they are best suited. At such times the foxes come into more frequent contact with people who are not well acquainted with them. These people are unaccustomed in philosophy or husbandry to living with red foxes, and, for example, after a few poultry losses occur, their fox neighbors generally become highly unpopular. In such instances, the demand for foxes quickly goes into reverse, and, interestingly enough, frequently remains so long after foxes have disappeared from the neighborhood.

The demand for foxes also goes into reverse when their population is swept by a rabies epizootic. Rabies epidemics usually take place among foxes that are in a state of oversupply.



This red fox den occupies a point of vantage on a sloping ridge in rough, wooded terrain.

This red fox den occupies a point of vantage on a knoll in open country.

The demand for foxes is usually in reverse among hunters who are primarily interested in small game. Poor hunting is often charged to foxes whether there are many, few, or none of them in the area in question.

At present, chief support for the red fox comes from among those who enjoy fox hunting as a sport and from those for whom this colorful fox imparts a special charm of wildness to the countryside. In active opposition to this fox are the small game gunners who feel that foxes make important inroads on game populations, farmers who hope to eliminate them as a cause for poultry losses, and those who are periodically alarmed about the role of this fox in the dissemination of rabies. There has been no demand for red fox fur in recent years. There was a little evidence, however, of revival of an interest in some long-haired furs during the 1954-55 season.

It has been suggested that the factors which condition the demand for the red fox are several and variable. Perhaps study of the most important of these factors will result in more accurate appraisals of the value of this fox than are general today.

The Red Fox as a Predator

The role of the red fox as a predator appears to be the most celebrated of the various factors affecting the economic position of this animal. The real importance of red fox predation is undeniably difficult to determine, but enough has been learned to provide a basis for attempting some reasonably accurate generalizations. Certain basic similarities seem to take form in recent investigations of the food habits of red foxes (Cook & Hamilton 1944; Errington 1935, 1937; Murie 1936; Scott 1943, 1947; Scott & Klimstra 1955).

The diet of the red fox is largely a product of characteristic responses of the fox to its environment. Within the limits of its food preferences, familiarity with the habitat, and physical capabilities, this fox tends to take the foods which are most readily available. Foods may occur in the

diet in an almost endless number of qualitative and quantitative combinations, which differ with such environmental properties as emergencies, season, year, and the general ecological character of the specific area. At one extreme is the situation in which the feeding fox may pay little or no attention to mice, rabbits, and other vertebrate prey animals when it finds an abundance of insects and fleshy fruits. At the other extreme, and of much less frequent occurrence, is the situation in which the fox may exert very severe pressure on vulnerably situated prey animals, as was witnessed in the case of muskrats when a marsh went dry (Errington & Scott 1945). Thus, environment plays an important part in establishing the pattern of the diet of the red fox.

The diet of the red fox does not reflect precise, automatic adjustments to changes in population levels of specific prey. For example, during the spring and summer, when prey such as rabbits, mice, and birds are found in increasing numbers, the frequency of occurrence of these items in the fox's diet declines where acceptable fleshy fruits and insects are available. Thus, it seems apparent that the relative availability of foods is important. It seems obvious, too, from the fact that prey populations frequently show strong year-to-year population trends that do not coincide with or follow population trends of red foxes, that these foxes surely do not normally limit prey numbers to an important degree.

Red fox predation and other forces of reduction do not control prey populations in the sense of constantly limiting them to certain levels. Prey populations frequently show year-to-year gains despite the pressure of all the mortality factors in their environment. Prey populations may also decline at rates in excess of the rate which could be induced by predation alone and may reach such low levels that foxes find subsistence difficult. The difficulty of finding food may be particularly noticeable when there are cubs to feed at the dens.

It is a mistake to claim or expect an increase in numbers of prey species in response solely to the reduction or elimination of red foxes. A large-scale experiment with reduction of a fox population as a means of increasing a pheasant population in New York (Anonymous 1951:22) resulted in the conclusion that "despite reducing the fox population to a very low level, fox control on the Seneca County area did not increase pheasant abundance appreciably and certainly not to a degree commensurate with the cost."

Prey animals show differences in vulnerability to predation by red foxes. Mice, especially meadow mice, appear to be taken by red foxes with considerable ease, and, while foxes do not control these forms, they constitute a force for mouse reduction. Perhaps fox-caused losses to such destructive forms of prey may be thought of as a compensation for losses among more desirable forms of prey.

Among the game species, bob-white quails seem to be relatively secure against fox predation (Scott & Klimstra 1955:94-6). Ring-necked pheasants appear to be more vulnerable than bob-whites, but pheasant losses do not reach alarming proportions. Arnold (1952*b*:127) failed to find a cause and effect relationship between an "irruption" in the numbers of red foxes in Michigan in 1945 and low numbers of pheasants in 1947 and concluded "that foxes have no major influence on pheasant populations and in all likelihood have little or no effect on them." Rabbits are highly vulnerable to capture by red foxes; however, no instance has been observed by the writer where fox predation has become so severe that it might not easily have been replaced by losses of another kind if foxes had been eliminated. It may prove enlightening to think of predation by red foxes as an age-old activity to which nature has adjusted long ago. If prey populations were not well endowed with the means of survival and if red foxes lived up to their reputations as deadly predators, it seems reasonable to believe that these foxes would have eliminated their means of subsistence and themselves generations ago.

Foxes unquestionably prey upon vulnerably situated poultry, small pigs, and lambs. It seems certain that only the poultry losses reach significant proportions. Losses of poultry to foxes, however, result largely from failure of poultrymen to follow recommended poultry husbandry practices. The restriction of laying flocks and broilers to pens and houses is a method of improving on egg and meat production, and even poultrymen who doubt that production is raised enough to justify the initial cost of this practice must admit that it is an effective means of eliminating losses to foxes and other predators. Important losses occur among pullets at times because leaving them on unfenced range until they reach laying age constitutes approved husbandry. However, even here something may be done to minimize the probability of loss. If such birds are not released from their roosting pens until after the sun is well up and are securely penned by the time the sun goes

down, there is little likelihood that foxes will develop the habit of taking them. Foxes do not seem prone to attack flocks which are located on range which cannot be approached unobserved. Poultrymen who dispose of dead chickens by dumping them in the fields surrounding the poultry houses may bait neighboring foxes to their areas. Some observers report that a good watch dog discourages the attentions of foxes in the vicinity of poultry yards.

Because red fox predation is strongly influenced by environment, it seems reasonable to believe that such predation may be modified through habitat management. Where fleshy fruits of kinds acceptable to foxes (kinds such as wild blackberry, serviceberry, wild black cherry, wild plum, and mulberry) are readily available, these foods comprise about one-fourth of the annual diet. Environmental alterations which provide such fruits may partially divert predation from such prey animals as upland game birds and other small animals. Perhaps it is significant that such foods, together with insects, are particularly available during the season of reproduction among prey species. Increased numbers of small game seem certain if predation pressures are buffered extensively not only by the provision of fruit for fox food but especially of adequate protective cover for these birds and other animals close to their nesting places and sources of food. The use of wild blackberry in cover plantings serves the dual purpose of providing excellent escape cover for prey and fruit for foxes. Habitat management, such as is described above, is obviously so generally

Knowledge of the structural characteristics of the feet of the red fox (left) aids in identification of tracks in the field. The small toe pads and furry nature of the feet are distinctive. The fore feet (above) are larger than the hind feet (below), and the heel pads of the fore feet are about twice as wide as those of the hind feet. The heel pads do not project forward between the toes as do those of the dog. The feet of the gray fox (right) are of size similar to those of the red fox, but the toe pads are much larger. The heel pads of the hind feet (below) are much smaller than those of the front feet. Photos from Iowa State College Experiment Station.

beneficial to wildlife that no amount of fox extermination can substitute for it.

Rabies and Red Foxes

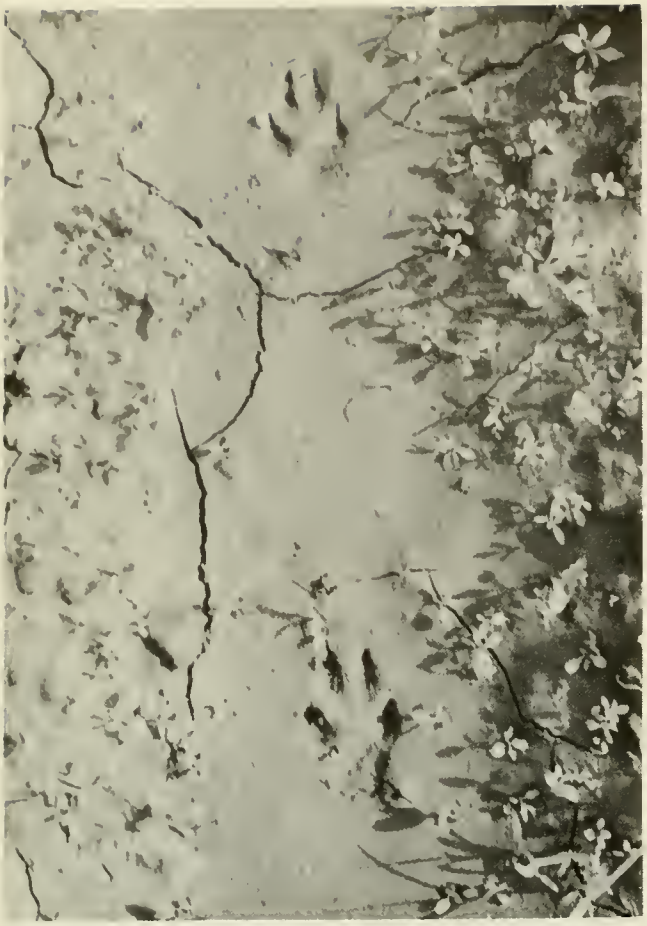
In a report on the work of the Expert Committee on Rabies, World Health Organization, foxes are listed among the most important vectors of rabies. The Committee's findings (Johnson 1951: 214), as related to rabies in foxes, were stated as follows: "As we learn more about the wild animal rabies problem in the United States, we can see the necessity for ecological studies to determine the relative importance of various wild animal vectors in the maintenance and spread of the disease. The epizootic of fox rabies that has been migrating about the eastern half of the United States for the past 10 years shows no immediate prospects of containment and has left many enzootic foci of the disease which continue to flare up from time to time. Reduction of the number of foxes in an infected area has proved effective in eliminating the disease there, but with few exceptions the policy has been to wait until the disease appears before considering to limit the fox population even if the disease is nearby."

Economic evaluations of rabies in red foxes have proved somewhat evasive because the extent to which the red fox is specifically involved in the rabies problem is largely unknown. The reports of diagnostic laboratories have usually limited fox identifications to the general category "fox." Red foxes were the only ones specifically named in a local outbreak in New York in 1943 (Compton 1945:70). In Virginia the majority of the foxes found rabid during a period of high rabies incidence in 1951 were gray foxes (Anonymous 1952: 4). In Ohio the occurrence of rabies in an outbreak discussed by Gier (1948:152) was predominantly in gray foxes. All except 1 of 159 fox heads which proved positive for rabies in a study of 419 heads collected during an epizootic in eastern Georgia, March, 1940, to November, 1941, were from gray foxes (letter of May 1, 1952, from Dr. Harald N. Johnson, Division of Medicine and Public Health, Rockefeller Foundation, New York). Perhaps the available reports may be interpreted to indicate that, for any given locality in which foxes are involved in a rabies outbreak, the dominant species in the population of foxes is the one most importantly involved. While our concern here is with the red fox, the role played by other wildlife species and domestic dogs in the dissemination of rabies should not be forgotten.

Irrespective of the degree to which red foxes may be involved, rabies still presents a problem which cannot be ignored in red fox economics. Perhaps of greater importance than economic loss is the mental distress, whether for practical reasons or wholly emotional reasons, of people living in an area where rabies has been reported, and the physical discomfort experienced by those undergoing the Pasteur treatment following an attack. It is certain that losses occur among livestock infected through the bites of rabid foxes. Colson & McKeon (1952:1) estimated that the value of farm animals destroyed after having been infected by foxes during an extended rabies outbreak averaged in excess of $50,000 a year in New York for several years previous to the time of their report. Gier (1948:152) reported that an undetermined portion of the losses from rabies among livestock must be attributed to foxes.

Experience with rabies epidemics in foxes was recently described by Moore (1950:14): "When rabies breaks out among foxes in a locality having a high fox population experience has shown that the sweep of the disease is likely to continue until the foxes in that general area are virtually exterminated. This may take from one to three years. Where the fox populations have been promptly and effectively reduced by control measures the period of danger has been substantially shortened in most instances. There is considerable evidence indicating that if the numbers of foxes are quickly reduced by well directed control operations the reduction need not be as drastic to accomplish the desired results as it usually is when rabies is allowed to run its course without any control effort." All of which indicates that there might be merit in the encouragement of a program of fox utilization which would obviate the build-up of excessively high fox populations.

The most desirable method presently known for bringing rabies outbreaks among foxes under control has proved to be population reduction by means of organized trapping. Moore (1950:35) found that "Extermination, except possibly in limited problem areas, is not considered necessary, and even in such places repopulation without [sic; within?] a short time would be permissible." Containment of the disease was accomplished in New York by trapping the foxes in broad zones, each about 50 miles deep, around the areas known to contain infected animals (Colson & McKeon 1952: 2-3). The trapping efforts were gradually shifted toward the centers of the regions of infection. Steele & Tierkel (1949:10-1) have stated that "The



The furry nature of the foot of the red fox is evident in these tracks in mud. The print of a fore foot of this fox is below; that of a hind foot is above.

Identification of these tracks in sand depends mainly on marks of the small toe pads. The print of the fore foot of a red fox is below, that of the hind foot is above.

objective in trapping procedures is to reduce the fox population more quickly than the disease will and thereby shorten the period of infection and the danger of its spread to other animals and man."

Control programs which are undertaken after rabies outbreaks occur are unreasonably expensive. A rabies epizootic is not economically desirable from the view of maintaining a healthy fox resource. Under normal circumstances, public opposition to the fox in many areas is out of proportion to actual damage done by the animal; rabies scares certainly do not promote in the public a more moderate attitude toward the fox. In one sense, the expenditure of money required to reduce a fox population in a rabies control program is the cost of restoring the population to health once infection has occurred. In other words, this seems to be an example of the price of mismanagement of a natural resource, for the evidence indicates that such an expenditure could be avoided or minimized by promoting the maintenance of fox populations at lower levels through hunting and trapping for sport or fur.

Red Foxes and the Bounty System

It seems likely that several million dollars may have been expended on fox bounties in the United States during the past 20 years. Perhaps the exact amount is not important to this discussion, for our concern is largely with economic policy.

The bounty system has been carefully reviewed and found wanting by a number of workers, in recent years by Arnold (1952*a*) and Hamilton (1946). Latham (1951:60-7) has reported what he believed to have been the advantages and disadvantages of the bounty system in general. The advantages which he listed for the bounty system seem to have been outweighed by the disadvantages, especially when controlling a red fox population constitutes the primary objective.

The tracks of a walking or trotting red fox are almost in line. Those of a domestic dog are more obviously staggered.

The tracks of a galloping red fox are in groups of four. Double trails, like these, may indicate the breeding season.

Bounty payments have been collected regularly on foxes that have been shot or trapped for fur, for sport, or for local control. Most of these foxes would have been killed anyway, and payment of the bounty has constituted a kind of deficit spending because it has meant payment on something for which value had already been received. Experience in Pennsylvania (Latham 1951:64) indicated "that probably 50 per cent or more of the mammalian predators (red fox, gray fox, and weasel) would... have been killed regardless of the bounty."

The bounty system cannot be directed efficiently toward the reduction of specific, excessive fox populations because the administrative areas in which funds are approved for bounties seldom conform with the areas needing attention. Any control technique must be considered wasteful of time and money if it cannot be directed against specific trouble spots.

Fraud takes many forms in a bounty system, and, undoubtedly, there are some techniques that are as yet not generally appreciated. The extent of fraudulent claims varies with provisions of the bounty law. For example, in Michigan the number of foxes bountied declined sharply when a law which designated township clerks as certifying agents for bounty payments was changed in the fall of 1951 to assign this responsibility to conservation officers (Arnold 1952*a*:3-4). Fraud as it relates to bounties may be largely a paper transaction involving the connivance of certifying agents, or it may result solely from the methods of the individuals seeking to collect bounties. The collection of bounties on foxes taken outside the area in which a bounty law applies is not an uncommon practice. Also, it is evident that bounties may be repeatedly paid on the same animal where evidence of the dead fox is not collected or marked in some effective manner. It is not unusual for some hunters or trappers who find the bounty profitable to release pregnant females in order to make certain that seed stock remains on the range.

This red fox cub, lying down, uses the cutting teeth on the side of the mouth while feeding.

The interest of this young red fox is attracted by a beetle found on a hunting trip.

Even if fraud is eliminated, the fox bounty promises to be one of the most costly means of controlling a fox population. The taking of foxes requires considerable time and effort; thus, the bounty must be attractive enough financially to provide sustained incentive for hunters and trappers. It is obvious that large sums of money must be expended to effect a significant reduction in a sizable fox population.

The bounty system is undesirable also in that it encourages killing during times of the year when the fur is unprime. Further, it is difficult even for the expert to trap in such a way as to avoid taking some animals other than foxes.

The bounty system has rarely accomplished the population control expected from it. In areas where this system has been in effect, such as in Pennsylvania (letter of April 2, 1952, from Dr. P. F. English, Department of Zoology and Entomology, Pennsylvania State University), populations have increased to levels where rabies epizootics have become an important consideration. In Michigan, it has been reported that more bounties were being paid on foxes in 1951, the fourth year of the fox bounty, than in the first year, 1948 (Arnold 1952*a*:3). In Wisconsin, Richards & Hine (1953: 74-5) have reported, "At the present time, if we judge the value of the bounty system on its 'predator control' feature, we must conclude that there is more evidence which indicates that the present bounty system is *not* controlling the fox populations than there is evidence that fox bounties are accomplishing their purpose."

While control programs commenced after populations have been permitted to reach extremely high levels seem less desirable than methods which anticipate and prevent build-ups to excessively high populations, the most suitable methods for use against high populations appear to be those that involve a carefully organized program of trapping and den hunting by paid employees. Den hunting, as practiced by the unskilled, is often undesirable because it usually means destruction of underground habitat and sometimes, directly or indirectly, of inoffensive wildlife species. It is highly desirable that control programs utilize the instruction and assistance available from trained state and federal officials.

If the bounty system could be properly administered, if its costs were not prohibitive, and if it were an effective method of population control, one of the chief results would be maintenance of a healthy fox population. It would seem less wasteful of public funds and more in keeping with the wise-use philosophy of conservation to stimulate the harvesting of surplus foxes for sport and fur rather than for bounty payments. Perhaps if a payment program were to be set up, it would be in closer conformity with modern economic views to provide it in the form of a price supports program for fur.

The Value of Red Fox Fur

The value of red fox fur is governed primarily by fashion. If long-haired furs are not in style, little or no market for fur of the red fox can be expected. In recent years, red fox pelts have been purchased by fur dealers and brokers but at very low prices. These purchases have been made not because there has been a demand on the market but because a few dealers and brokers have been willing to speculate on the future prospects for this fur. Large numbers of red fox pelts are being held in storage houses all over the country (letter of August 26, 1953, from J. F. Staudt, Hudson's Bay Company, New York).

It seems virtually impossible to determine the monetary value of the red fox fur crop in the United States. Many of the records maintained by states fail to distinguish between red foxes and gray foxes, and there are apparently no other readily available figures on the catch. Ashbrook (1948: 2) has estimated that between 900,000 and 1,000,000 foxes were taken each year in the United States for the 5 or 10 years preceding 1948. This estimate does not reveal the number that were red foxes.

When the fur of red foxes again becomes fashionable, trapping pressure will increase, probably in proportion to the price level. The demand will tend to meet and possibly exceed the harvestable surplus. The overpopulation problem will probably be solved and possibly replaced by the problem of controlling the take at a desirable level.

The Esthetic Value of Red Foxes

A few outdoorsmen, some who hunt and some who do not, enjoy an appreciation of the esthetic values of the red fox. The simple act of observing a red fox in the field is a notable event. And the observation of a red fox hunting mice in a meadow or of a litter of pups playing at a den adds something very special to a day in the field. The tracery of tracks marking the doings of this fox in the winter snow is intriguing in itself and leaves a feeling of well-being with those who sense that something is lacking in a nature without foxes.

The secretive nature of the red fox tends to make realization of its esthetic values difficult. It seems almost certain, however, that esthetic appreciation will come to anyone who is enough of an outdoorsman to make an effort to observe and become familiar with the animal.

Red Fox Hunting

The economic value of fox hunting involves a consideration of the various forms in which it is practiced. In general, there are two schools of thought on fox hunting: (1) that in which the fox is pursued by hounds principally for the thrill of the chase and (2) that in which the primary goal is the death of the fox.

Fox hunting for the chase is one of the oldest forms of sport hunting in America. Early records indicate that it was commonly practiced by the gentlemen farmers of colonial times. History records that George Washington maintained hunters and a pack of fox hounds. Washington's diary contains somewhat detailed accounts of his fox hunts.

Through the years, several breeds of fox hounds have been painstakingly developed for the chase. Walker, July, Trumbo, Trigg, and Birdsong have become familiar names to the American fox hunter.

Few sports enjoy a following which has greater enthusiasm and loyalty than that associated with fox hunting for the chase, either mounted or dismounted. To some, it is not merely a sport; it is virtually the manifestation of a way of life attended by a rigid code of ethics.

While estimates of the monetary worth of hunting are exasperating in their lack of preciseness, perhaps such estimates as are available may aid in measuring the importance of fox hunting for the chase. L. F. Gingery (letter of March 21, 1952), editor of the *Red Ranger*, a journal for fox hunters, estimates that approximately 200,000 people and 800,000 hounds are engaged in this sport. These figures do not include persons and hounds engaged in the more formal sport associated with the organized Hunts. The average value of a fox hound on the currently advertised market is about $40. Thus, estimates indicate that fox hounds valued at about $32,000,000 are now being used in this sport. Replies to a recently circulated questionnaire indicate that the cost of feeding a hound for one year is at least $40 (letter of August 25, 1953, from Gilbert Mather, of Philadelphia, member of the Masters of Foxhounds Association of America). Based on this figure, the annual cost of feeding the 800,000 fox hounds is $32,000,000. There is an additional investment in veterinary fees and such equipment as dog collars, kennels, and trailers for transporting the hounds. Probably at least half of the fox hunters engaged in this sport attend

The sportsman who hunts the red fox alone and without a dog faces a severe test of stamina and woodsmanship. Photo from the Pekin *Daily Times*.

Hunters prepare to cast the hounds for a chase. Photo by William E. Clark.

Hounds rest after a long chase. Photo by Hy Peskin, from *Sports Illustrated.*

one or more field trials or bench shows every year and expend a substantial amount for transportation, meals, and lodging.

The above estimates do not include expenditures incurred in mounted fox hunting. There are 107 Hunts which are registered or recognized by the Masters of Foxhounds Association of America (Mather, letter of August 25, 1953). Of these, four are in Canada and three are presently inactive, leaving 100 active Hunts in the United States. There are additional Hunts which are not affiliated with this association, but there is no record of their number. Mounted fox hunting represents a considerable investment. The organized Hunts maintain an average of about 38 hounds each, or 3,800 hounds. These Hunts also employ many people, such as professional huntsmen, whippers-in, kennel men, and grooms.

The Hunt clubs and their members own a large number of hunters, horses especially bred and trained for fox hunting. About 5,000 horses are in use in organized fox hunting. In addition to their fox hunts, the Hunts stage a large number of race meetings, horse shows, and hunter trials.

Perhaps the sale of red foxes to fox hunters who wish to stock their ranges should be mentioned. Usually such foxes have been obtained as cubs taken from dens and held for sale at a later date. They are bought because there are few or no foxes in the area which is being hunted or because it is believed that the running qualities of the foxes on the range will be improved by addition of new blood. Occasionally, they are used in "drop hunts," in which the foxes are held captive until released for the chase. This practice is not approved by the Masters of Foxhounds Association.

Killing the fox by the hunter is considered unethical in parts of the country inhabited by those who believe in running foxes for the chase simply as a test of stamina, speed, and ability of the hounds to follow the trail. The hunt is terminated when the trail is lost, or the fox is "marked to earth" or killed by the hounds. It is widely recognized that the red fox runs before the hounds better than the gray fox, and, in areas where both foxes occur, the killing of the grays may be practiced in the belief that when the reds are displaced by grays the quality of the chase deteriorates. Thus, some areas have, in the red fox, a resource that may be utilized without removal of the annual surplus. Whether some of the foxes are killed makes little difference in these areas, except that removal of excess numbers provides for a healthy and productive fox population, minimizes the hazards of a rabies infection, and possibly improves the quality of hunting by reducing the number of trails.

Hunting for which the death of the fox constitutes the primary objective is carried on largely in the northern states. It may be practiced in a wide variety of forms. The fox is sometimes trailed by two or three hounds while the hunter, with a gun, conceals himself on a likely crossing. Also the red fox may be decoyed within shooting range with a call which simulates the squeal of a rabbit in distress. Seagers (1945:55-6) has described a novel method of hunting called "belling" or "tolling." One hunter moves through good fox territory

following a fox trail and ringing a dinner bell. He is accompanied at a distance by another hunter who attempts to shoot any fox curious enough to come within range.

Perhaps the greatest degree of stamina and woodsmanship is required by those who trail foxes on a good tracking snow with the objective of maneuvering within shooting range of the animals. Sometimes fox drives are conducted which involve the participation of large numbers of hunters. The group participation made possible in such fox drives is enjoyed by many hunters, but this kind of hunting is not always accepted by landowners.

Thus, there are many interesting and novel ways in which foxes may be hunted. However, the sport of fox hunting obviously needs more participants if the annual surplus is to be removed. Fox management should include a program for the encouragement of this sport. It is a kind of hunting which, if practiced in a sportsmanlike manner, tests skill and stamina to a high degree and provides opportunities for outdoor activity over a long season. It holds possibilities for reducing fox numbers to levels that result in healthier populations. It also directs the attention of sportsmen away from the false hopes of larger game populations through fox destruction to the more wholesome attitude of a new opportunity for expanding the hunting recreation through utilization of the fox resource.

Conclusions

An attempt at appraisal of red fox values encounters a disconcerting array of points of view. It seems evident, nevertheless, that the inherent economic worth of the red fox is something more than that which has been appreciated by the public.

An appraisal of the economic position of the red fox leads to the following conclusions:

1. The red fox has demonstrated a remarkable ability to survive in a hostile environment and at times has reproduced so efficiently as to become too numerous for its own best interests.

2. As a predator, it seldom exerts important pressures on wild prey, and the poultryman could minimize losses to chickens by following recommended poultry husbandry practices.

3. The red fox, in times of overpopulation, is among the important vectors of rabies. It seems likely that management practices designed to maintain red fox populations at reasonable levels would minimize the occurrence of rabies epizootics in this species.

4. The bounty system, as applied to the red fox, is wasteful and fails to accomplish its intended purpose.

5. The value of red fox fur is unstable because it is dependent upon fashion.

6. This fox possesses an esthetic worth that is appreciated by some outdoorsmen and would be more widely appreciated if more came to know it.

7. The values of the red fox to sport hunting are diverse and not fully exploited, and these values are of more constant worth than those derived from its fur.

The economic position of the red fox could be greatly improved through the following remedial adjustments:

1. The encouragement of an increased use of red foxes for sport hunting, including the removal of surplus animals in areas where killing by hunters is now considered unethical. The objective here would be the expansion of an underdeveloped field of sport hunting and the prevention of excessive population build-ups.

2. The education of those who hope for increased small game populations through fox extermination campaigns to the more concrete and lasting results that may be expected from habitat improvement programs. On most areas, small game populations can be increased by providing a better distribution of protective cover near nesting places and sources of food.

3. The elimination of bounty payments on red foxes.

4. The enactment and enforcement of more effective antirabies laws, especially as applied to the compulsory vaccination and quarantine of domestic dogs, and prompt reduction by organized trapping of red fox populations in which rabies epizootics occur.

5. The increased attention by game managers to the proper management of the red fox resource in general, including assistance with the cropping of surplus animals in areas where adequate cropping has not been accomplished by hunters.

Acknowledgments

While the writer is grateful to many people for aid in making this evaluation of the red fox, special acknowledgment is due James S. Ayars of the Illinois Natural History Survey, Dr. W. J. Hamilton, Jr., of Cornell University, Dr. Paul L. Errington of Iowa State College, Dr. W. D. Klimstra of Southern Illinois University, and Gilbert Mather, Philadelphia, member of the Masters of Foxhounds As-

An organized Hunt takes to the field to enjoy the thrill of riding to the hounds. Photo from the *Chronicle*.

sociation of America. For some of the photographs, the writer is indebted to Everett H. Appel, Illinois Department of Conservation, Springfield (cover photograph); Adolph Murie, Moose, Wyoming; Iowa State College Experiment Station, Ames; Otho Woodruff, Green Valley, Tazewell County, for photo from the *Daily Times*, Pekin, Illinois; William E. Clark of the Illinois Natural History Survey; *Sports Illustrated*, Philadelphia (photos by Hy Peskin); Karl Koontz and Freudy Photos for photo from the *Chronicle*, Middleburg, Virginia. Photos not credited are by the writer.

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Hounds continue the chase long into the night. Photo by Hy Peskin, from *Sports Illustrated.*